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Penicillin Allergy

Penicillin is one of the most commonly reported drug allergies, and yet 90% of people who think that they're allergic to it are actually not. It is very common for individuals who have been labeled with an allergy to penicillin to report that they have been diagnosed with this allergy since as early as they can remember and that they do not actually recall the initial instance when they had the reaction. So where does this misconception actually come from and why is it beneficial to know if you are actually allergic to penicillin?

What is penicillin allergy?

An allergy is a rare reaction where the body's immune system mounts an attack against an allergen and can cause anaphylaxis. Penicillin allergy occurs when your body's immune system recognizes penicillin as a harmful, foreign substance and targets it for destruction. Prior to developing this response, you body needed to have had at least one prior exposure to the drug in order to develop a sensitivity. When your immune system develops a sensitivity to a drug, this means that it has created an antibody to the drug that can then recognize any future foreign invaders with the same properties. Therefore, the next time an exposure to penicillin occurs, the sensitized individual will develop a reaction as the antibody recognizes and mounts an immune response against the drug.



Why are 9 out of 10 people actually not allergic to penicillin?

Many individuals have been told since childhood that they are allergic to penicillin, however a large portion of these cases have resulted from mislabeling a side effect of the drug as an allergy. Side effects of a drug are non-life threatening reactions which do not involve an immune response. Common side effects include nausea, diarrhea, and headaches. It is also common for patients to mistake symptoms caused by the infection being treated, such as a rash, as a reaction to penicillin. Individuals who were truly allergic in childhood also have an 80% chance of losing this allergy over a period of 10 years.

Why should I be tested for a penicillin allergy?

Individuals who have been labeled with a penicillin allergy will not be given penicillin or other related drugs. However, it has been found that as a result, these individuals will be prescribed drugs that are often not as effective as penicillin or can pose a greater risk for adverse effects, such as *C. diff* or MRSA, which are antibiotic resistant infections. As penicillin is an extremely effective and safe drug to use, it is more beneficial for individuals who can tolerate penicillin to receive it when needed. Patients mislabeled with penicillin allergy may also have longer hospital stays and higher medical costs.

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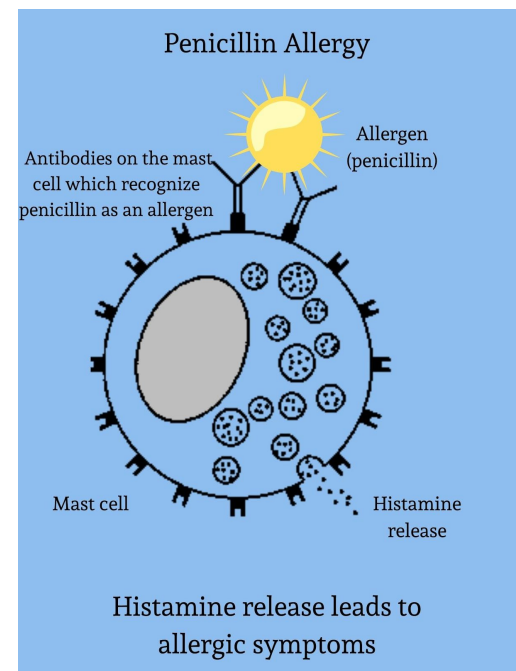
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How does penicillin work?

Penicillin is part of a class of Beta-lactam antibiotics that work to destroy bacteria by breaking up their cell wall. Bacteria cell walls are made up of a molecule known as peptidoglycan, which consists of sugars and polypeptides. When penicillin enters the body, it prevents the cross-linking of the bacterial peptidoglycan, which ultimately causes the bacteria cell to die as the cell wall cannot form properly. As peptidoglycan is not found in human cells, it is safe to take penicillin since it will only target the bacterial cells.

What is a drug allergy?

A drug allergy is an abnormal immune response to a medication. When the body first comes into contact with the drug, it recognizes the drug as a harmful substance, or an allergen. The allergen will first interact with what is known as a B cell, which is a type of white blood cell that produces antibodies in order to help fight off infections. The B cell will engulf the antigen, or the drug, and take a piece of the drug to be presented on the surface of the B cell. Cells known as T helper cells then bind to the part of the drug that is presented on the B cell. The T helper cell will become activated by this binding and release a host of molecules which stimulate the B cell to mature into a plasma cell. As a plasma cell, antibodies known as IgE are able to be produced and released from the cell. IgE molecules make their way to mast cells where they dock onto receptors on the surface of the cell. At this point, the body's immune system is said to be sensitized to the drug as they are prepared to mount an attack against the drug in the future should re-exposure occur. In the event that the drug is taken again, it will bind to receptors on the IgE molecules which ultimately leads to the activation of mast cells and the release of inflammatory molecules, such as histamine. The release of these molecules happens fairly quickly following ingestion of the drug and leads to the onset of symptoms including itching, rash, hives, swelling, difficulty breathing and even anaphylaxis.



What is drug intolerance?

Drug intolerance is a non-allergic reaction that does not involve the immune system. Symptoms of a drug intolerance can include diarrhea, nausea, or a headache. As this adverse reaction does not involve the immune system, patients with a drug intolerance can still take the medication and are not at risk for having a serious, anaphylactic reaction to the drug.

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What delayed reactions are possible?

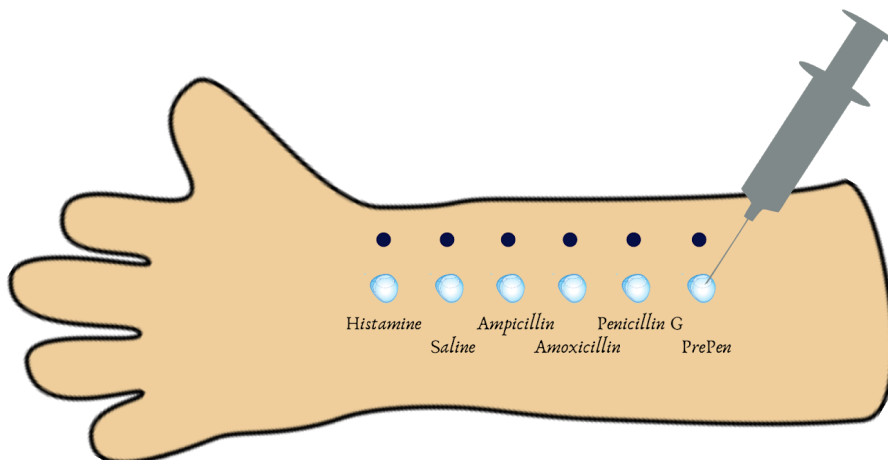
Delayed reactions are another type of reaction that patients can develop in response to taking penicillin, although they are typically less severe than immediate drug allergies. Upon entering the body, penicillin is recognized by a different part of the immune system with cells known as T cells. T cells will recognize the penicillin antigen on antigen presenting cells in the immune system, bind to the complex containing the antigen, and lead to the release of proinflammatory molecules which can ultimately lead to symptoms of itching, rash or hives. Generally this process takes around 48-72 hours, therefore leading to the name of a delayed hypersensitivity.

What type of reaction does penicillin allergy test for?

As delayed hypersensitivities take around 48-72 hours to occur, penicillin skin testing can only detect immediate hypersensitivities. However, as immediate hypersensitivity could be the most life threatening type of reaction, if a patient successfully passes penicillin allergy testing and oral challenge then it is safe for them to take penicillin in the future. While delayed reactions can still happen, it tends to be mild and rarely life-threatening. One could be treated through mild delayed reactions with oral antihistamines or oral steroids in order to finish the course of the antibiotic treatment.

How does penicillin allergy testing work?

Penicillin allergy testing involves a series of three tests. The first part of penicillin allergy testing is prick testing. During the prick testing, multiple suspected penicillin forms are pricked on the skin and are compared to a positive control, histamine, and a negative control, saline, in order to determine if a reaction occurs. The patient will wait 15 minutes between each round of prick testing and if this testing is unremarkable, then intradermal testing will be initiated. During intradermal testing, a small amount of the suspected forms of penicillin are placed just under the skin. Again, these will be compared to both a histamine, or a positive control, and saline, or a negative control. There are also two rounds of intradermal testing where the patient will wait 15 minutes between each round. If this testing is also unremarkable, then an oral challenge will be performed. During the oral challenge, a dose of penicillin derivative will be given to the patient, who will then be observed in the office for an hour to ensure no reaction occurs.



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Is there anything I need to do before testing?

You will not be allowed to take antihistamines for 7 days prior to the testing as this medication can disrupt the results. You should also make sure to obtain a referral from your primary care provider prior to testing if your insurance requires it.

How long does testing take?

Testing typically lasts between 2.5 to 3 hours, depending on how well the patient tolerates each step. If at any point during the testing a positive reaction is observed, testing will be stopped and it will be concluded that the patient is allergic to penicillin. It is recommended to bring a book or another form of entertainment during testing in order to pass the time.

What to expect after testing

If all stages of testing are completed, including the oral challenge, the patient will be asked to monitor their symptoms for 24 hours in order to ensure that no delayed reactions occur. Any serious reaction to the oral challenge will occur within one hour of the dose, which is the time that the patient will be observed in the office. Any delayed reactions following this time will be mild, if any, and can be treated with antihistamines. It is important to note, however, that any symptoms observed, such as hives, swelling, rash, or itchiness, within these 24 hours can indicate an allergy to penicillin. The patient is then asked to report their progress to the clinic 24 hours after testing in order to make sure that none of these reactions occurred.